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(54) Title: IMPROVEMENTS IN OR RELATING TO GOLF PUTTING SIMULATORS
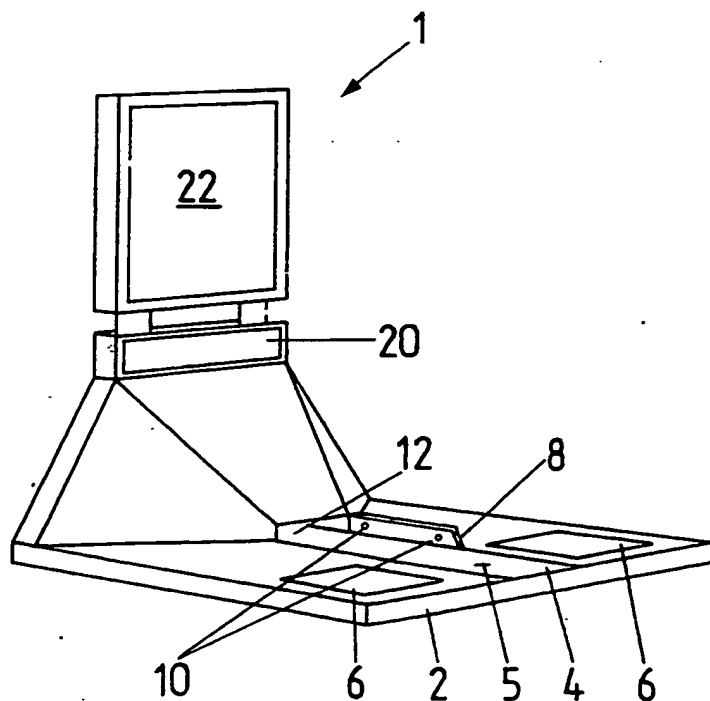
(57) Abstract

A golf putting simulator (1) includes selection means (32) for selecting the speed of the putting green surface, sensor means (10) for measuring the speed of the ball and for calculating the distance travelled by the golf ball from a predetermined position on the surface towards the target, distance setting means (34) for setting the position f the target, and indicator means (36) for indicating putting performance.

IMPROVEMENTS IN OR RELATING TO GOLF PUTTING SIMULATORS

This invention concerns improvements in or relating to golf putting simulators.

In particular, the invention has reference to an electronic golf putting simulator which can be used for training,
5   practice or competitive purposes.

It is already well known for golfers to practice their putting away from the green on a specially designed, usually synthetic, surface with substantially constant physical characteristics, over a predetermined length with a target or
10 cup representing the hole. A disadvantage of practising in this way is the familiarity generated as a result of continued use, thereby reducing the challenge value and accordingly the efficacy of the activity in improving the golfer's putting ability.

15 Electronic golf putting simulators have been proposed for simulating the performance of golfers by calculating the speed of the ball and its direction, thus enabling the golfer to monitor and measure the likely accuracy of the putt in reaching the target hole. However, the disadvantage of such
20 simulators resides in their inability to impose any external parameter which will necessarily affect the performance of the ball in its path towards the target hole following the putting stroke. Accordingly a less than realistic simulation of putting performance is achieved.

25 One of the principal parameters influencing putting performance is the speed of the green, which is a function of the frictional resistance it exhibits. It is already known manually to assess the speed of a green with a simple device originating in the United States of America and called a
30 Stimpmeter (Trade Mark) produced by the US Golf Association which in association with the Royal and Ancient of St Andrews Scotland interprets golfing rules. Essentially, the device

consists of a grooved bar provided with a notch for initially engaging a golf ball. Upon elevation of one end of the bar the ball will disengage the notch and roll down the groove and onto the ground beneath the lower end. Briefly, by measuring

5 distances rolled by a number of golf balls over the ground, which will constitute the putting green, and averaging those distances, a value for the green speed can be calculated. It is thus possible to generate various data which will determine the speed of the greens on a particular golf course and

10 categorise those greens in general terms such as fast, medium-fast, medium, medium-slow, or slow. The golfer can, therefore, with the benefit of this information, vary his putting accordingly.

An object of the present invention is to provide an improved

15 electronic golf putting simulator which allows a more accurate assessment of putting performance.

According to the invention an electronic golf putting simulator includes an artificial putting green surface providing a path over which in use a golf ball will be caused

20 to travel by a user of the simulator, a visual display including a representation of a target, selection means for selecting the speed of the putting green surface, sensor means for measuring the speed of the ball and for calculating the distance travelled by the golf ball from a predetermined

25 position on the surface towards the target, distance setting means for setting the position of the target, and indicator means for indicating putting performance.

Conveniently, means may also be provided for detecting the directional path taken by the golf ball and for giving via

30 the indicator means, a visual indication thereof.

The visual display may be constituted merely by a panel

incorporating inter alia the representation of the target
which may be illustrated by a flag or a hole per se with a
direct line of sight to the target appropriately marked
thereon to give guidance to the user. The panel may also be
aestheticised with static pictorial golfing scenes.

In an alternative form of visual display, a sequentially
illuminative panel may be provided with a suitable lighting
array actuable upon initiation of the putt to illuminate the
panel progressively to illustrate the path taken by the putted
golf ball towards the target.

In a further alternative embodiment, the visual display may
comprise a visual display unit (VDU) or monitor which is
adapted to provide the user with a display of the progress of
the ball following the putting strike together with the
representation of the target, the position of which can be
changed on the screen of the unit upon actuation of the
distance setting means. The user can thus see in a graphical
manner the effect of distance variation.

Conveniently, the simulator is provided with an integral
computer which is programmed to set the various parameters of
green speed and target distance and to compute the performance
of the user dependent upon the speed and direction of the
ball, the indicator means providing information with regard to
both distance achieved by the putt and the path taken by the
ball following impact.

The selection means for selecting the speed of the putting
green surface may conveniently be incorporated within the
computer and are calibrated to provide a range of speeds.
The range of speeds may advantageously be that achieved by use
of green speed data calculated for example by the use of a
Stimpmeter (Trade Mark) as advocated by the United States Golf

Association.   Ranges of speed may c rrespond to regular membership play or tournament play and the simulator may provide for the selection of either of the two ranges with options within each range for a designated green speed.

5   The sensor means for measuring the speed of the ball as putted by the user of the simulator may comprise two conventional detectors spaced apart a known distance along the intended path of the golf ball, the time taken from one detector to the next being measured in milliseconds and the speed calculated
10 therefrom.

The simulator requires to be calibrated in order for meaningful user performance assessments to be made, and accordingly the computer is suitably programmed with reference data to provide the requisite facility for the user to be
15 given the relevant information on the indicator means following despatch of the golf ball along its path towards the target.

Operation of the simulator, which will preferably electrically powered, may be initiated by a simple on/off activation
20 element, for example when the simulator is to be used in a private environment. In the alternative, however, and as a preference, the operation of the simulator is initiated by a suitable payment mechanism when the simulator is intended to be used commercially. The payment mechanism may be adapted
25 to accept currency or as a preferred alternative to accept a prepaid card. In this latter case, a suitable card reader is provided for the simulator either as an integral part thereof or associated therewith. The prepaid card may be of kind in which one payment for one single operation of the simulator is
30 available, in which event the card reader would consume the card to trigger use for a predetermined time on the simulator. As an alternative, the prepaid card may be of a

kind in which one payment will purchase more than a single operation of the simulator, in which event the card reader will subtract the relevant charge and return the card to the user.

5   The simulator is preferably provided with a ball return mechanism which is adapted to return the or each spent golf ball to the vicinity of the predetermined position on the putting green surface for further use. In the case of a simulator in commercial use, the returned ball will not be

10   accessible until the requisite fee is disbursed and reinitiation of the simulator commenced. Alternatively, the user may use his own golf balls in which case, they are retrievable.

In practice, the user will either initiate operation by use of

15   the on/off facility or by suitable payment, and will then select the green speed and the distance setting before addressing the golf ball on the predetermined position on the putting green surface. The user will then strike the ball and the sensing means will detect its speed and dependent

20   inter alia upon the green speed setting, will calculate the distance the ball would travel towards the target and the directional path taken by the ball. The simulator will in practice for commercial application, provide the user with a timed access which will be continually displayed to give the

25   user of the unexpired time left for play.

By way of example only, embodiments of golf putting simulator according to the invention are described below with reference to the accompanying drawings in which:

Figure 1 is a perspective schematic view of the
30   simulator;

Figure 2 is a front elevation of part of the simulator shown in Figure 1;

Figure 3 is a side elevation cut away to show details
of the simulator;

Figure 4 is a front elevation of a further detail of
the simulator;

5   Figure 5 is a front view of the control panel of the
simulator;

Figure 6 is an alternative view to that shown in
Figure 1;

Figure 7 is a front perspective view of a further

10   embodiment of the invention;

Figure 8 is front perspective view of the lower part
of the embodiment shown in Figure 7; and

Figure 9 is a front elevation of a control panel for
the simulator of the invention.

15   Referring first to Figures 1 to 5 of the drawings, there is
shown generally at 1 a golf putting simulator including a base
2 on which is located centrally and longitudinally thereof an
artificial putting surface 4 which is provided with a start
position 5 from which in use a golf ball (not shown) is to be

20   despatched.   On each side of the surface is a mat 6 for a
right or a left-handed user of the simulator 1.   A runner 8
(only one of which is shown) is set alongside and extends
parallel with each margin of the surface 4 to define generally
a path for the golf ball to follow.   Two sensors 10 are set

25   in at least one of the runners 8 and are spaced apart a
predetermined distance;   the sensors are in the form of
detectors and are adapted in use to detect the passage of the
golf ball and the time taken for the ball to travel the
distance from one sensor to the next, thereby to calculate the

30   speed of the ball.

The surface 4 extends towards the rear of the base 2 where it
terminates adjacent an opening 12 through which a golf ball
will in use travel following a putt by a user.   To the rear
of the opening 12 is an area in which an array of further

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sensors 14 is located and arranged to detect the directional
path of the travelling golf ball.   A ball arresting and
return arrangement is shown diagrammatically at 16 for
decelerating and redirecting the ball from its path along a

5   return channel (not shown) terminating in a collection or ball
queueing area (not shown) adjacent the start position 5.

The simulator 1 is provided with a computer (not shown) of
which a control panel 20 is illustrated generally in Figure 1
and in greater detail in Figure 5.   The panel 20 is disposed

10   above the opening 12 and has mounted thereon a visual display
22 depicting a target in the form of a hole 24 with a caddie
represented at 26 holding a flag 28.   A direct path 30 to and
beyond the hole 24 is shown as are two diverging paths 32
either side thereof.   In this example, all paths are provided

15   on the panel with suitable illuminative means, namely lamps,
to indicate in progressively highlighted fashion the path
taken by the ball.

The control panel 20 is provided with a start button 21 which
is adapted to initiate operation of the simulator 1.   In an

20   alternative embodiment (not shown) initiation is occasioned by
insertion of a prepaid card in a card reader mechanism, such
for example as that produced by Thorn EMI as a motorised LBS
Card Reader 1004 TO.   Also provided on the control panel 20
is the green speed setting means in the form of buttons 33

25   which bear speed categories, namely fast, medium/fast, medium,
medium/slow and slow.   The categories are determined by for
example the use of a Stimpmeter (Trade Mark) as described
herein, and are programmed into the computer for manual
selection by a user of the simulator.

30   The panel 20 is provided with distance setting means 34 for
electronically setting the distance of the target hole 24 from
the start position 5.   The means 34 ar in the form of two
buttons which as illustrated either increase or decrease the

distance set.   An indicator means 36 includes two elements,
one comprising a digital read-out located at 37 showing on the
left the distance set and on the right the distance actually
achieved.   The other element of the indicator means 36
5   comprises a small panel which is adapted to illustrate the
directional path taken by the ball, and accordingly includes
three indicators 38 which can be illuminated to show the
accuracy or deviation of the path taken by the ball.   The two
elements of the indicator means thus provide a measure of
10 performance of the user against the parameters of green speed
and target distance.

The computer requires to be programmed in order to enable
satisfactory operation for the user and to provide meaningful
performance assessment.   Accordingly, there is described
15 below one method of calibrating the simulator for this purpose.

Essentially the simulator of the present invention operates by
measuring the speed of the ball as struck by the user to
calculate the distance likely to be travelled having regard
inter alia to the green speed setting.

20 The calibration of the computer involves two steps, namely the
actual measurement of the distance travelled by a golf ball on
a known surface, and the computer calculation of that result
to generate appropriate distance and comparison tables.

For the first step, the sensors 10 measure the travel time of
25 the struck ball in milliseconds and several sets of readings
are taken for 'speed' against distance travelled.   Usually
ten readings for each of ten distances are sufficient,
although more readings over more distance would give a better
accuracy and linearity to the final results.

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In the second step, the menu driven calculator program performs within the following guidelines:

Maximum ball travelled distance   = 127 feet (38.71m)

Minimum ball travelled distance   = 2 feet (0.91m)

5   Maximum target distance (to/from) = 63 feet (19.35m)

Number of green speeds   = 7

(Each green speed is a 22% increase in distance travelled from the previous, as derived from published information, eg the Stimpmeter readings.)

10   The distance comparison table is automatically generated from the above information being a result generated from the subtraction of two variables, namely the ball travelled distance (2-127 feet) and the distance to/from the pin (63-127 feet).

15   The ball distance table is generated from the measured timing and distances by calculation, and therefore can be used to customise the simulator for specific sites.

The generation of the table is as follows.

The following basic information must be entered:

20   A) The number of calibration distances taken (usually 10), the allowable range being 5-25.

B) the green speed for the calibration distances, the allowable range being 1-7, 7 being the fastest.

C) Average values or not. If set, average values require 10

25   readings per distance to be input.

Timing and distance values for each of the distance points must be entered, distances can be in inches or feet, or a metric measurement if so desired, with the program automatically adjusting between either. Timing values must

30   be in whole milliseconds. If average values are required, then the program will input 10 values, average and store the

result.   Values will be stored directly when averaging is not required.

Once all the distance point have been input, generation of the table follows automatically as follows:

5   1)   The input points are stored into an array at a
          position corresponding to the time value;

     2)   Each of the calibration points entered then has a
          multiplier in ft/sec value calculated and stored;

     3)   The 'ends' of the table are filled in using the last
10   or first multiplier values as appropriate;

     4)   Intermediate points are then filled in by calculating
          the multiplier value as a function of its position
          between the input calibration points;

     5)   Having found multipliers for each of the 1023 possible
15   times for the speed of a ball, the distance travelled
          for each time is then calculated and placed in the
          table, after being limited to the 2-127 feet range of
          the simulator

The table now contains all the calibrated information required
20 to generate a disk file for the 7 possible green speeds
available.   Using the inputted green speed, the program now
generates the required file in hexadecimal format.   This file
can be converted by most proprietary programming tools to an
acceptable format, for example the Intel Hex.

25 The generated file contains 7 sets of the calculated table,
with each set being a 22% increase over the previous set.
All data are again limited to the simulator's 2-127 foot range
for ball distances travelled.

As previously mentioned, the comparison table is generated
30 from the subtraction of two known variables, ie ball travelled
(2-127 feet) and distance to/from the target (2-63 feet), with

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the output values being in a disk file in hexad cimal format
as for the distance table.

In summary, therefore, the distance achieved is found by
applying the time a ball takes to travel a known distance to a
5   calibration table and then comparing the result with the
distance to the target to give a displayed value, in feet, of
the distance that the played ball would be when referred to
the target.

The simulator when programmed in the manner indicated above
10   thus provides an accurate performance assessment of the user
within the parameters both internally and externally set.
The user effectively prescribes the conditions to be applied
in terms of green speed, and target distance and the computer
responds accordingly dependent upon the monitored ball path
15   characteristics.

Referring now to Figure 6, an alternative form of simulator is
shown which differs in two principal areas from that depicted
in Figure 1. The visual display 22 constitutes a full
backdrop to the simulator and includes a representation of the
20   target bounded on both sides by illustrations of different
golfing scenes to aestheticise the visual impact of the
simulator. The control panel 20 is disposed centrally of the
backdrop with an improved fascia incorporating a card reader
mechanism (not shown).

25   In operation, the user activates the simulator and selects the
green speed and the target distance, addresses the golf ball
on its position on the green surface, and strikes the ball.
The simulator automatically calculates the distance attained
by the ball and the directional accuracy of the putt, thereby
30   providing a ready indication of the putting performance of the
user.

Referring now to Figures 7 and 8, there is depicted a further embodiment of the invention in which the simulator 60 includes a base 62 having an upstanding structure 64 towards the rear part thereof.   An artificial putting surface 66 is provided

5   on the base 62 and has a start position centrally of the front of the base approximately as shown by the golf ball 68.   On each side of the start position is a mat 70 for right or left-handed users of the simulator.   A runner 72 is set on each side of the start position each housing sensors (not

10 shown) for detecting the passage of a golf ball and the time taken for the ball to travel the distance from one sensor to the next, thereby to calculate the speed of the ball.

The surface 66 extends towards the structure 64 which is provided with an aperture 74 over which is set a target line

15 plate 75.   The aperture 74 is formed in a slot member 76 in which are housed directional sensors (not shown) which are adapted to sense in use the line of the struck golf ball. The member 76 has an upwardly inclined ramp 78 of a small angular disposition to the horizontal, and registers with a

20 ball return arrangement (not shown) which is provided with a downward slope leading to a discharge tunnel 80 and a reception bowl 82 set in the base 62 in front of the structure 64.

The structure 64 is provided with a control panel 86 directly

25 above the aperture 74, the panel being appropriately connected to a computer (not shown) housed within the structure.   A suitable panel 86 is shown in more detail in Figure 8 to which reference is now made.   A card slot 88 for insertion of a payment card is provided in the face of the panel and a start

30 button 90 is also set therein.   In commercial simulators, the insertion of a card purchases a predetermined time of use and the unexpired time is visually displayed at the top of the panel 86 in an illuminated window 87 for a read-out, for example light emitting diodes.   The panel also has

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illuminable control buttons for setting the green speed, ranging from slow 92 to super fast 104 through medium/slow 94, medium 96, medium/fast 98, fast 100, and extra fast 102, the categories being defined in accordance with readings provided

5   by the Stimpmeter (Trade Mark).

Controls 110 are also provided on the panel 86 for setting the target distance of the putt, by increasing or decreasing the value from a default value prescribed by the computer.   A visual display 112 of the target distance is given in a window

10 114 which also give in use a display of the distance achieved by the user of the simulator.   Directly beneath the window is an array of lights 118, 119, and 120 depicting the direction of putt as sensed by the sensors in the slot member 76.

In operation, the user inserts a card in the slot 88 which

15 purchases a playing time of for example ten minutes. Instructions to a user are arranged at a suitable location either on or adjacent the simulator.   The initiation of play occasions default lights to illuminate the medium/fast button 98 and to show a default target distance of say 12 ft (3.66m)

20 at display 112 in window 114.   The green speed may be changed by depression of the appropriate button to give the desired setting, and the target distance may be altered by use of the controls 110 to increase or decrease same.   The user initiates play by depressing the start button 90 which starts

25 a count down mechanism, the unexpired playing time being displayed at 87.   Depression of the start button 90 also activates the sensors in both the runners 72 and the slot member 76.

The user stands on one of the mats 70 and addresses the ball

30 68; the ball is struck by the user and aimed at the target line plate 75.   As the ball rolls along the putting surface, it passes the speed-measuring s nsors mounted in the runners 72.   The ball then passes through the aperture 74 in the

member 76 wherein its directional path is sensed. The computer calculates the speed and the direction of the ball and provides at the appropriate places on the panel a visual indication of the values. In particular, the window 114 will
5   show a distance coupled with an appropriate positive or negative sign to indicate the degree to which the putt has over or under achieved the preset target distance. The illuminable lights 118 to 120 provide the user of the simulator an indication of the accuracy of the line taken by
10   the ball during its path through the member 76 in relation to the target line plate 75.

The display of one shot will remain on the panel for a preset time, for example five seconds, after which the panel will reset to the default settings. The user may then input new
15   settings or retain the default settings and play again within the unexpired time indicated at 87. Upon expiry of that time period the computer will switch off the simulator which can be reinitialised by the insertion of another card.

The simulator of the invention thus provides a more accurate
20   assessment of user performance than hitherto possible with known equipment, and furthermore the simulator may itself be used competitively in addition to fulfilling its role as an aid to improving the putting game of the participant.

CLAIMS

1. An electronic golf putting simulator includes an artificial putting green surface providing a path over which in use a golf ball will be caused to travel by a user of the simulator, characterised by a visual display including a representation

5   of a target, selection means for selecting the speed of the putting green surface, sensor means for measuring the speed of the ball and for calculating the distance travelled by the golf ball from a predetermined position on the surface towards the target, distance setting means for setting the position of

10 the target, and indicator means for indicating putting performance.

2. An electronic golf putting simulator according to Claim 1 characterised in that means are provided for detecting the directional path taken by the golf ball and for giving a

15 visual indication thereof.

3. An electronic golf putting simulator according to Claim 1 or 2 characterised in that the visual display is constituted by a panel incorporating the representation of the target.

4. An electronic golf putting simulator according to Claim 3

20 characterised in that the target is illustrated by a flag or a hole together with a direct line of sight to the target appropriately marked thereon to give guidance to the user.

5. An electronic golf putting simulator according to Claim 3 or 4 characterised in that in which the panel is aestheticised.

25 6. An electronic golf putting simulator according to Claim 1 or 2 characterised in that the visual display includes a sequentially illuminative panel provided with a suitable lighting array actuable upon initiation of the putt to illuminate the panel progressively to illustrate the path taken by the putted golf ball towards the target.

7. An electronic golf putting simulator according to Claim 1 or 2 characterised in that the visual display comprises a visual display unit or monitor which is adapted to provide the user with a display of the progress of the ball following the
5   putting strike, together with the representation of the target the position of which can be changed on the screen of the unit or monitor upon actuation of the distance setting means.

8. An electronic golf putting simulator according to any one of the preceding claims and characterised by an integral
10   computer programmed to set the parameters of green speed and target distance and to compute the performance of the user dependent upon the speed and direction of the ball, the indicator means providing information with regard to both distance achieved by the putt and the path taken by the ball
15   following impact.

9. An electronic golf putting simulator according to Claim 8 characterised in that the selection means for selecting the speed of the putting green surface are incorporated within the computer and are calibrated to provide a range of speeds.

20   10. An electronic golf putting simulator according to Claim 9 characterised in that in which the range of speeds is achieved by use of green speed data calculated by the use of a Stimpmeter (Trade Mark).

11. An electronic golf putting simulator according to any one
25   of the preceding claims characterised in that the sensor means for measuring the speed of the ball as putted by the user of the simulator comprises two conventional detectors spaced apart a known distance along the intended path of the golf ball, the time taken from one detector to the next being in
30   use measured and the speed calculated therefrom.

12. An electronic golf putting simulator according to any one of the preceding claims and characterised by a ball return

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mechanism which is adapted to return the or each spent golf ball to the vicinity of the predetermined position on the putting green surface for further use.

13. An electronic golf putting simulator according to any one
5 of the preceding claims characterised in that operation of the simulator is initiated by a simple on/off activation element.

14. An electronic golf putting simulator according to any one of the preceding claims 1 to 12 characterised in that the operation of the simulator is initiated by a suitable payment
10 mechanism.

15. An electronic golf putting simulator according to Claim 14 characterised in that the payment mechanism is adapted to accept currency.

16. An electronic golf putting simulator according to Claim 14
15 characterised in that the payment mechanism is a prepaid card reader.
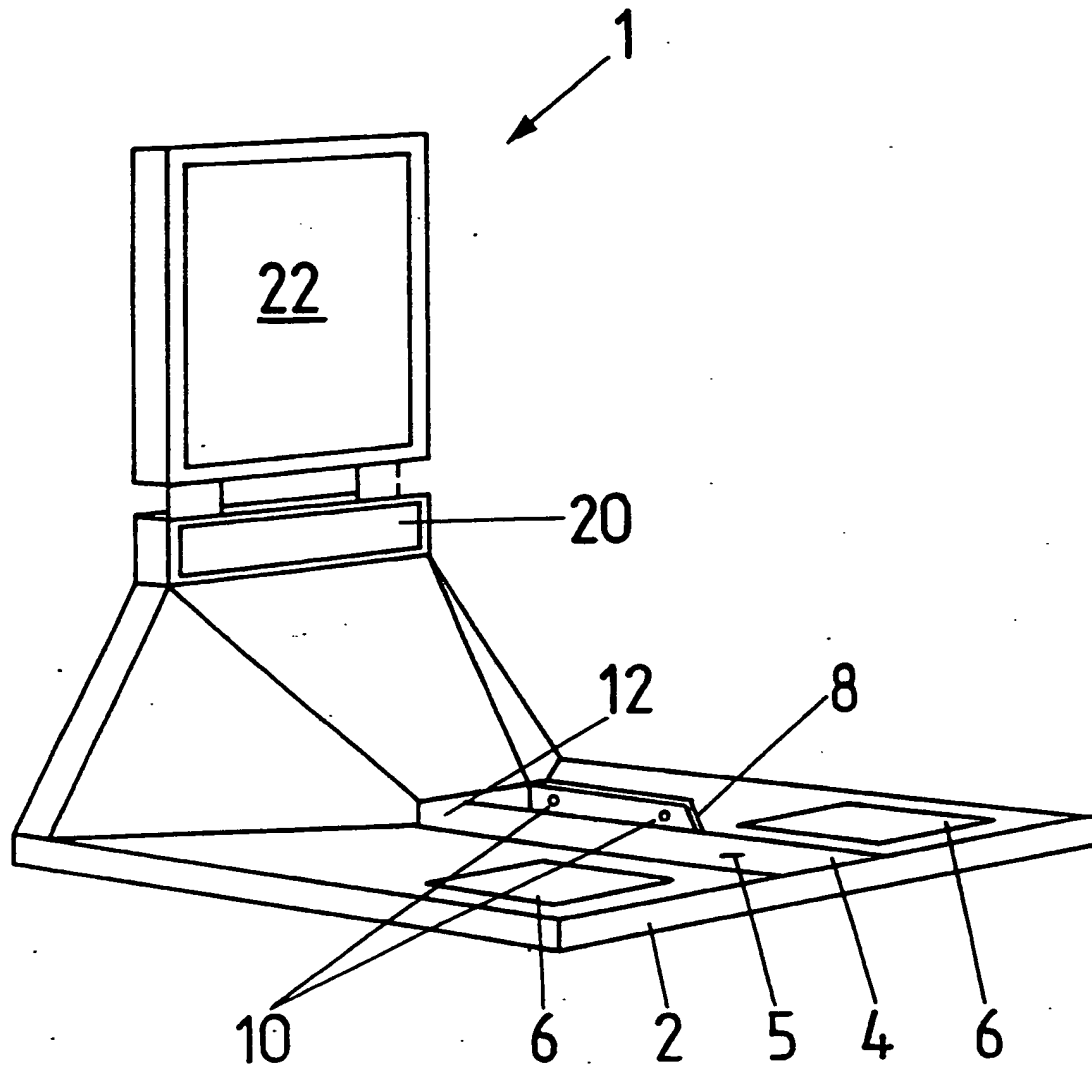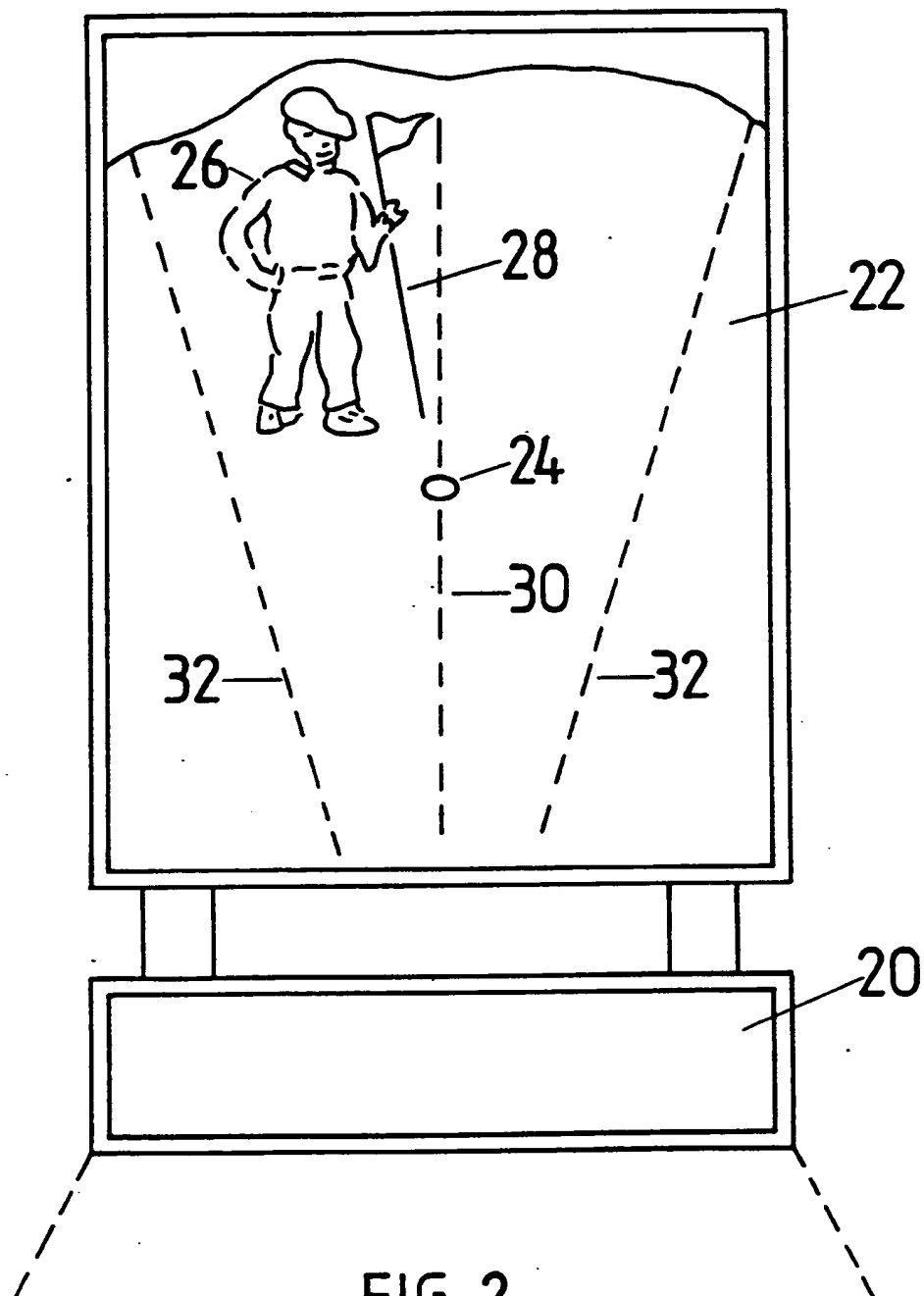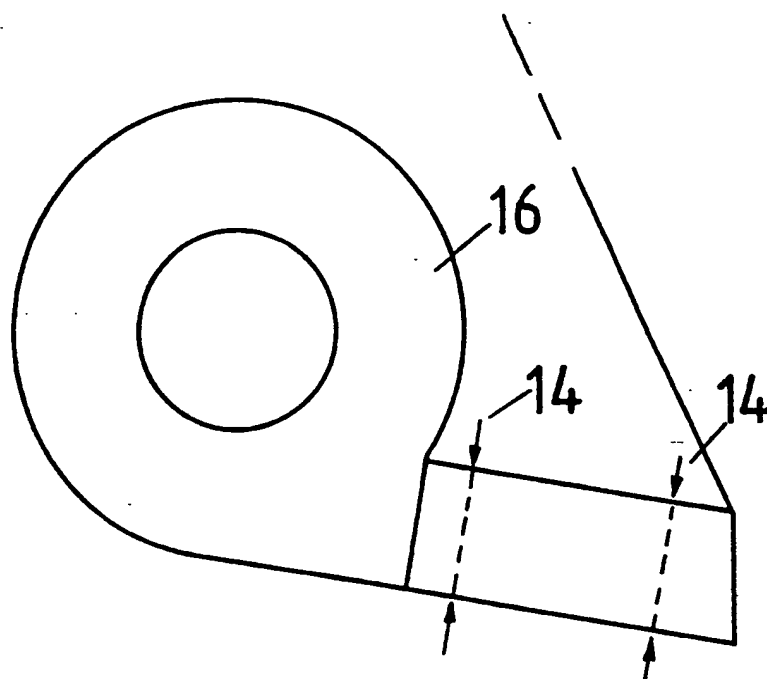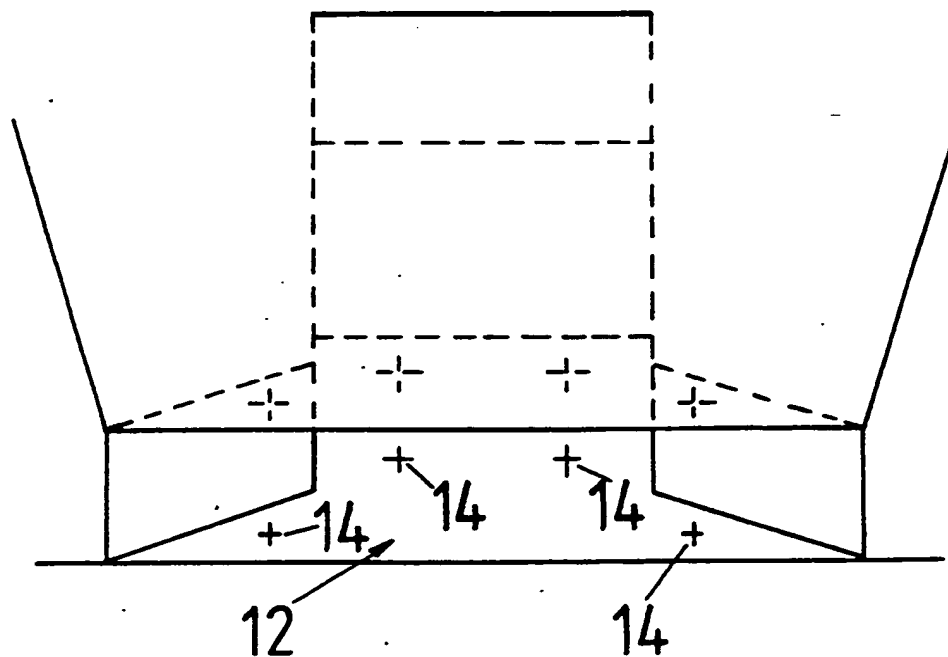
1/8

FIG. 1

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FIG.2
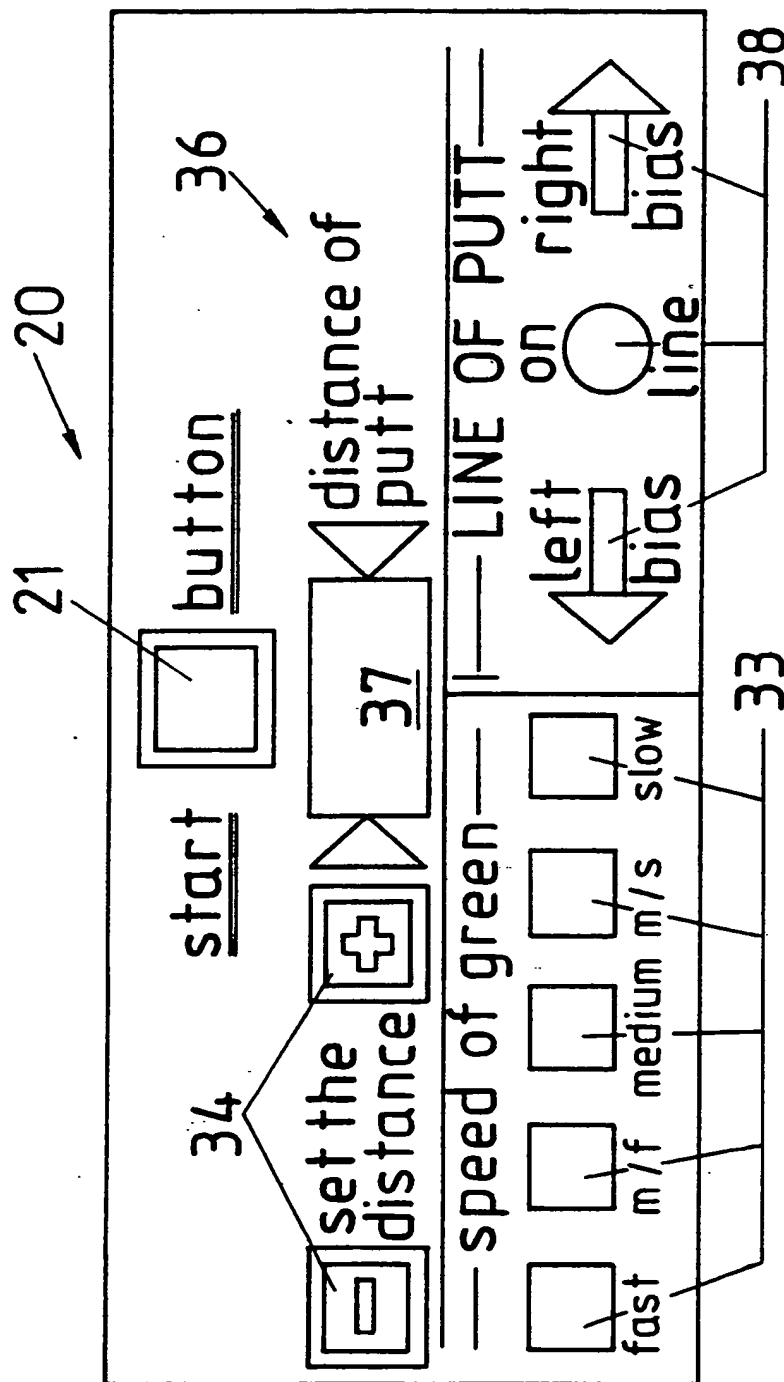
FIG. 3

FIG. 4

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FIG. 5

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FIG. 6

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START
BUTTON

FIG 7

FIG. 8

ADJUST GREEN
SPEED

104 — □ SUPER FAST
(10'-6')

□ GAME
TIME — 87

102 — □ EXTRA FAST (9'-6')

100 — (8'-6') □ FAST

STIMPMETER
GREEN SPEEDS
IN BRACKETS — 86

98 — (7'-6') □ MEDIUM FAST

96 — (6'-6') □ MEDIUM

94 — (5'-6') □ MEDIUM SLOW

110

92 — (4'-6') □ SLOW

START □ — 90

⊕   ⊖

ADJUST
DISTANCE   114

DISTANCE
OF PUTT
(IN FEET)   DISTANCE
ACHIEVED
(IN FEET)

112   □ — 119   □ — 120
           LEFT   ON LINE   RIGHT

118   DIRECTION OF
                   PUTT

INSERT CARD

_____
| |
|_____| — 88
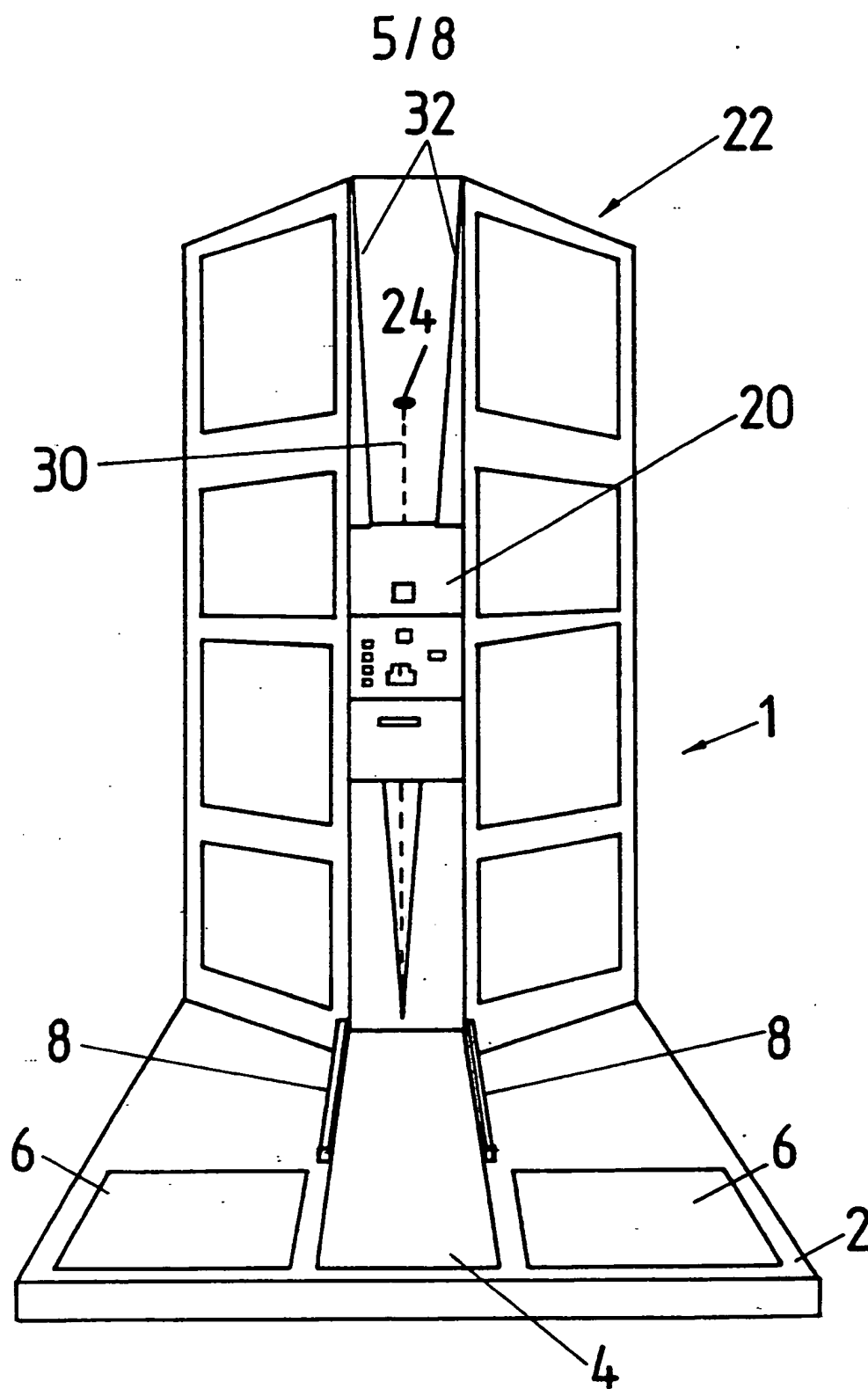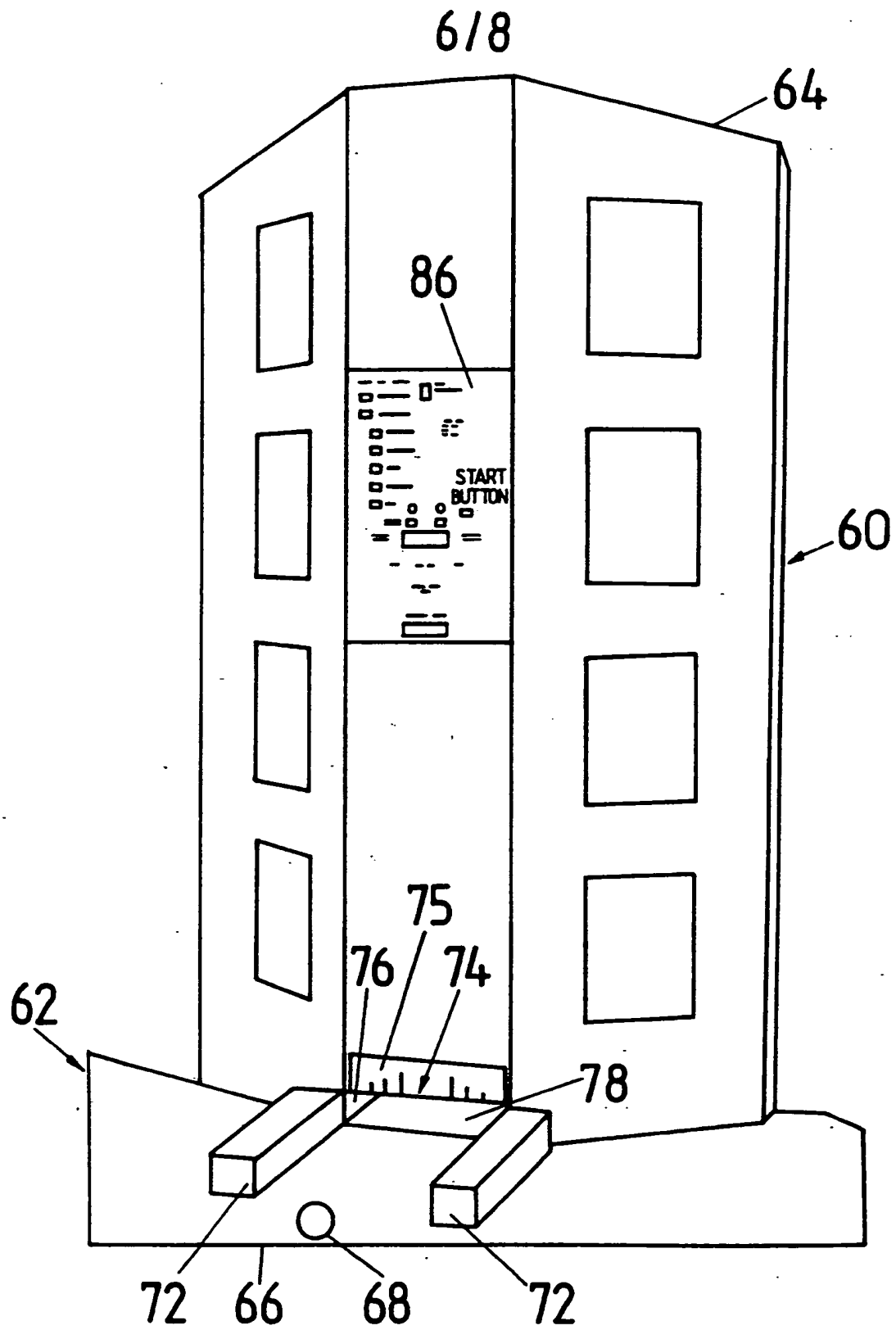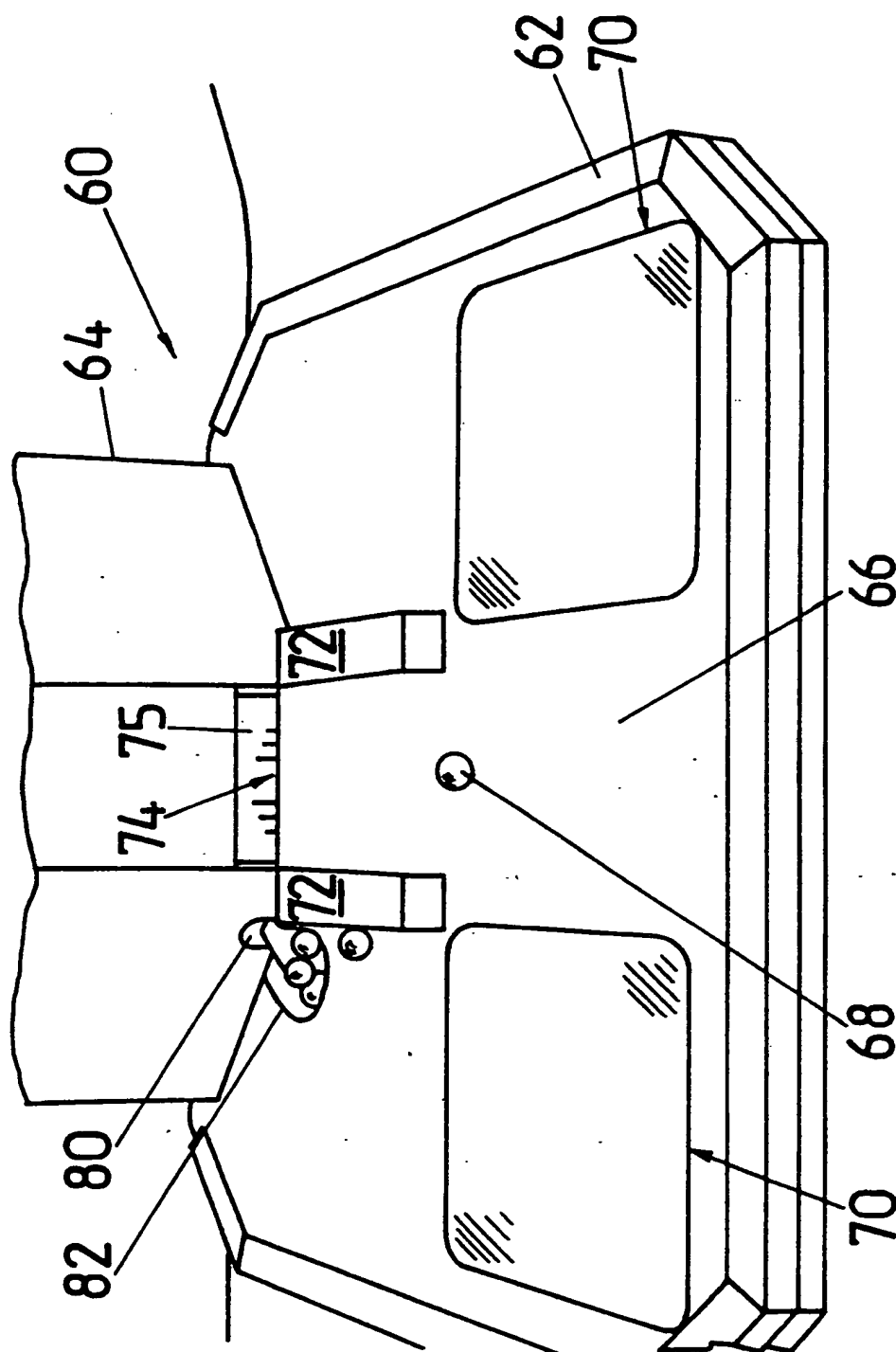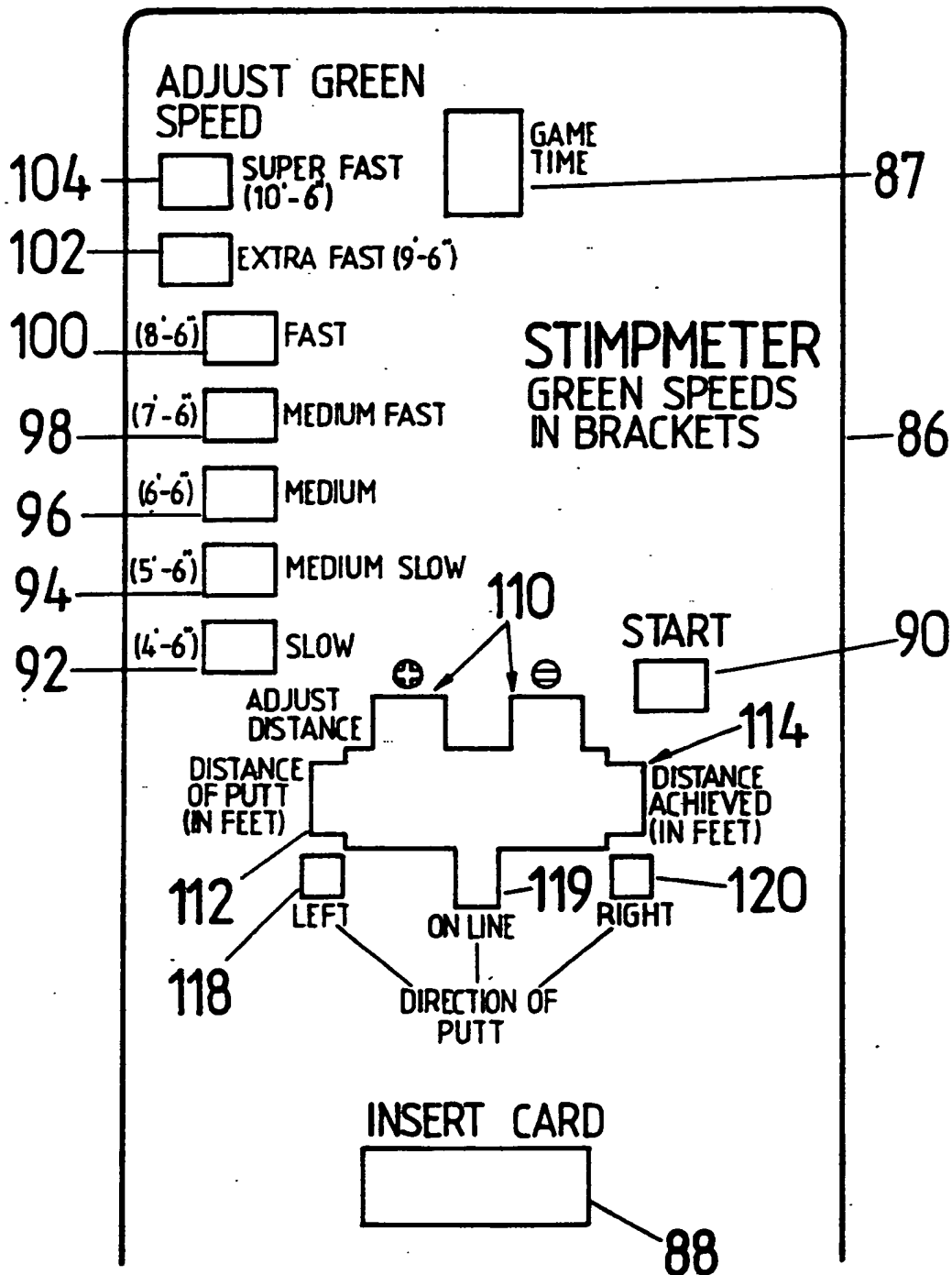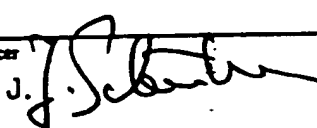
FIG. 9

International Application No

I. CLASSIFICATION OF SUBJECT MATTER   (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl. 5 A63B69/36

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
Int.Cl. 5	A63B

Documentation Searched other than Minimum Documentation
to the Extent that such Documents are Included in the Fields Searched[8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category°	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
X	US,A,4 343 469 (KUNITA ET AL.) 10 August 1982 see column 1, line 5 - line 10 see column 2, line 54 - column 4, line 35 see column 15, line 3 - column 16, line 18 see column 16, line 46 - line 55 see figures 1-3	1-4,7-9, 13
Y		11,12, 14,15
Y	WO,A,8 906 995 (TGM TECHNOLOGY PTY LTD) 10 August 1989 see page 4, line 16 - line 22 see page 5, line 24 - page 6, line 9 see page 8, line 21 - page 9, line 2 see page 11, line 12 - line 23 see figures 1-3	12,14,15

-/-

° Special categories of cited documents :[10]

"A" document defining the general state of the art which is not considered to be of particular relevance

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

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"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
26 FEBRUARY 1992	0 4. 03. 92
International Searching Authority	Signature of Authorized Officer
EUROPEAN PATENT OFFICE	SCHOENLEBEN J.

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		Relevant to Claim No.
Category°	Citation of Document, with indication, where appropriate, of the relevant passages	
Y	GB,A,2 154 146 (ESSEX) 4 September 1985 see page 1, line 39 - line 44 see figures 1,2 ---	11

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the European Patent Office EDP file on
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		JP-A-	55148574	19-11-80
		JP-B-	58043117	24-09-83
WO-A-8906995	10-08-89	None		
GB-A-2154146	04-09-85	None		

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